THERMOACOUSTICS REVIEW MEETING
13-15 NOVEMBER 1996
ASILOMAR CONFERENCE CENTER
PACIFIC GROVE, CA

The Jamie Whitten National Center for Physical Acoustics

The University of Mississippi

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THERMOACOUSTICS REVIEW MEETING
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PREFACE

The purpose of the Thermoacoustic Review Meeting (TARM) was to succinctly review the Office of Naval Research basic (6.1) work in the Thermoacoustic Cooling program and to hold a meeting for extended discussions and some related presentations. The participants included the ONR Thermoacoustic Cooling program Principal Investigators, colleagues, ONR Headquarters reviewers, and other invited appropriate Navy and other participants.

TARM was held November 13-15, 1996 at the Asilomar Conference Center, a California State Park facility in Pacific Grove California, on the Pacific Ocean near Monterey, California. One reason for selecting the Asilomar site was to convene near a place where there is on going thermoacoustics research. On the afternoon of Thursday 4 November, there was an opportunity to visit some thermoacoustics research facilities at the Naval Postgraduate School in nearby Monterey California.

The ONR funded presenters were asked to tell participants, including some without a thermoacoustic background, what they have tried to do, what they have done, how it relates to other thermoacoustic work, why it is important, what are the unresolved issues, and what are their plans. Similar guidelines applied for presenters not in the ONR 6.1 Thermoacoustic Cooling Program. Specifically those participants representing potential users were asked to comment on the potential application of thermoacoustic cooling in the fleet.

The Asilomar review proved to foster extended discussion outside the scheduled sessions. The organizers are grateful to the participants who made this meeting effective and the professional staff at Asilomar.

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SYNOPSIS OF MEETING

Each presenter provided copies of overhead transparencies used for his/her presentation. Copies may be obtained by contacting the appropriate individual listed under the Availability section below. Unavailable from the authors are comments from the potential users represented by Dr. Frank Stone, Mr. Bruce Unkel, and Mr. Daniel Winegrad. Some of their comments are summarized in the following.

The Navy strives to protect the environment and to abide by international treaties and connections. The Navy has undertaken large programs to eliminate the use of CFC's in the fleet. Expensive and extensive retrofits have changed most air-conditioners to CHFC's as refrigerants. Even as the conversions take place, there is a recognition that CHFC's may be phased out in the next decade. An alternative will be required when that time arrives and thermoacoustics appear promising.

The cooling requirements on a ship are staggering -- hundreds of thousands of tons. A reasonable starting point for thermoacoustics might be supplemental, stand alone units. Three ton "window" units are common. Perhaps a thermoacoustic replacement would be feasible both in cooling requirements and compactness.

LIST OF PRESENTATIONS

Thermoacoustics Basics
Anthony A. Atchley, Naval Postgraduate School

Shipboard Heat-Driven Thermoacoustic Coolers
Thomas Hofler, Robert Keolian and Anthony Atchley, Naval Postgraduate School

Radial Wave Thermoacoustic Engines
W. Patrick Arnott, Desert Research Institute; Richard Raspet, Jay Lightfoot and Henry E. Bass, University of Mississippi

Heat-Driven Thermoacoustic Coolers
Richard Raspet, Henry E. Bass, James Brewster, Gordon Smith and Jay Lightfoot, University of Mississippi

Mechanically-Driven Thermoacoustic Coolers
Steven L. Garrett, Pennsylvania State University

Small Mechanically-Driven Thermoacoustic Coolers
Orest G. Symko, University of Utah

Thermo-Fluid Mechanic Study of Thermoacoustic Devices
Andrea Prosperetti, Omar Knio and Cila Herman, John Hopkins University

Anisotropic Heat-Exchanger/Stack Configurations for Thermoacoustic Heat Engines
Jay D. Maynard, Pennsylvania State University

Properties of Thermoacoustic Working Gases†
Michael R. Moldover and Keith A. Gillis, NIST-Gaithersburg

Thermoacoustics under Water (THAW)
B. Gabrielson, Pennsylvania State University; William C. Ward, Los Alamos National Laboratory; and Steven C. Black, NRL Orlando

TRITON Thermoacoustic Cooler††
Steven L. Garrett, Pennsylvania State University

Magnetically Enhanced Thermoelectric Cooling and a New Approach to the Materials Problem
Albert Migliori, S.A. Trugman, T.W. Darling, and M.F. Hundley, Los Alamos National Laboratory; J.L. Sarrao, Florida State University; Z. Fish, NHMFL

Optimizing the Design of Thermoacoustic Cooling Systems
B.L. Minner, J.E. Braun and L. Mongeau, Purdue University

OTHER MATERIALS

Design Optimization of Thermoacoustic Refrigerators
Martin Wetzel and Cila Herman, Johns Hopkins University

Design Issues of a Thermoacoustic Refrigerator and Its Heat Exchangers
Martin Wetzel and Cila Herman, Johns Hopkins University

Expanding the Applications of Holographic Interferometry to the Quantitative Visualization Oscillatory Thermofluid Processes using Temperature as Traces
Cila Herman, Eric Kang and Martin Wetzel, Johns Hopkins University

Properties of Working Fluids for Thermoacoustic Refrigerators (Annual Report to ONR)
Michael R. Moldover and Keith A. Gillis, NIST-Gaithersburg

Practical Determination of Gas Densities from the Speed of Sound Using Square-Well Potentials
K.A. Gillis and Michael R. Moldover, NIST-Gaithersburg

AVAILABILITY

Unless otherwise noted, all presentations and other materials are available in plain paper copies from Libby Cauthen, NCPA, University of Mississippi, University MS 38677; 601-232-5808 (voice), 601-232-7494 (fax), eacauthe@olemiss.edu.

†Available from Michael Moldover or Keith Gillis, NIST, Physical and Chemical Properties Division, Gaithersburg MD 20899-0001; 308-869-4020 (fax), keith.gillis@nist.gov, michael.moldover@nist.gov.

††Available from Steven L. Garrett, Applied Research Laboratory, Pennsylvania State University, P.O. Box 30, State College PA 16804; 814-863-6373 (voice), 814-865-3119 (fax), garrett@sabine.acs.psu.edu

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13. ABSTRACT *(Maximum 200 words)*

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